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AUTHOR Ayllon, Teodoro; Kelly, Kathleen
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ABSTRACT

Reported are five studies related to the effects of a token reinforcement system based upon principles of operant conditioning on academic performance of trainable mentally retarded (TMR) children, conducted over a 9-month period in an entire school for TMR students. Study 1 investigated the effects of a school-wide reinforcement program on standardized test performance. Study 2 found that noncontingent delivery of reinforcement (tokens) decreased the rate of correct academic responses (the target behavior) and, in some cases, increased the rate of incorrect responses. Study 3, which manipulated the required behaviors leading to reinforcement, showed a direct relationship between actual work output and stated requirements for earning reinforcement. Experiment 4 found that when available work time was decreased, rate of correct responding increased. The final study involved a short-term (5 week) program using token reinforcement to identify TMR students who could function in an EMR (educable) setting. (KW)

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A NINE-MONTH TOKEN REINFORCEMENT PROGRAM FOR THE TRAINABLE RETARDED

Atlanta Public Schools

Atlanta, Georgia

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R E S E A R C H A N D D E V E L O P M E N T R E P O R T

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A NINE-MONTH TOKEN REINFORCEMENT PROGRAM FOR THE TRAINABLE RETARDED

Prepared by

The Center for Applied Behavior Research
Georgia State University

Teodoro Ayllon, Ph.D., Director

Assisted by

Kathleen Kelly, M. A.

Dr. Jarvis Barnes
Assistant Superintendent
for Research and Development

Dr. John W. Letson
Superintendent

Atlanta Public Schools
224 Central Avenue, S. W.
Atlanta, Georgia

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PREFACE

Dr. Teodoro Ayllon, Director, The Center for Applied Behavior Research, Georgia State University, has been actively engaged in studies which have applied behavioral techniques in the Atlanta Public Schools for the past three years. The results from several projects conducted at Milton Avenue School for the trainable retarded pupils have given support to the effectiveness of token reinforcement for academic performance.

The present study, at Milton Avenue School, was funded under the Elementary and Secondary Education Act of 1965 (ESEA), Title I, and subcontracted to Dr. Ayllon who was assisted in preparing the report by Ms. Kathleen Kelly. Included in the report are the details of a behavior modification program with the major focus upon the trainable mentally retarded curriculum coupled with token reinforcement for correct performance on academic material. The study emphasizes the identification of transitional procedures in a regular trainable mentally retarded classroom orientation to a school-wide coordination of efforts with full-scale token reinforcement.

Jarvis Barnes
Assistant Superintendent
for Research and Development

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The authors wish to thank Dr. Jarvis Barnes for his confidence in our efforts throughout this project. From the initial proposal through the implementation phases to this final report, his interest and enthusiasm have been constant supports.

To the teachers, teacher aides, and all personnel at Milton Avenue School, we extend our sincere thanks. Your willingness to experiment and to step into new educational modes made our experience with you both productive and rewarding.

To one person, however, is due a debt which can never be repaid. Paula Calhoun, principal of Milton Avenue School, was willing to attempt new ideas when others would not listen. She would encourage innovations and raise questions when others were satisfied with the status quo. Furthermore, she recognized progress and sought for further achievements when the successes were still small. This report would not have been possible without Paula; few educators are willing to make the personal investment she enthusiastically gave. Thank you, Paula, for believing and then helping to make it a reality.

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INTRODUCTION

Behavioral techniques have been extensively applied in a wide variety of educational settings. Wolf, Giles, and Hall (1968) used points as conditioned reinforcers to raise the academic performance level in a remedial classroom. Madsen, Becker, and Thomas (1968) found that the combined use of rules, systematic praise, and ignoring of inappropriate behaviors was most effective in maintaining classroom control. Craig and Holland (1970) found that the attending behavior of deaf children could be dramatically increased by the systematic application of reinforcement. Other studies have focused upon outdoor play behavior (Beull, Stoddard, Harris, and Baer, 1968), instruction following (Zimmerman, Zimmerman, and Russell, 1969), and the effect of delayed reinforcement in a grammar school child (Schwartz and Hawkins, 1970). These are only a sample of the varied studies conducted in educational settings which have successfully employed operant techniques.

Milton Avenue School for the Trainable Retarded in Atlanta has been the site of several large-scale experiments over the past three years. The first major project was conducted during the summer school session, 1969. Two separate studies demonstrated the effectiveness of token reinforcement in increasing academic performance. In one experiment, Metropolitan Readiness Tests (MRT) scores increased by more than 25 per cent over the initial test scores after only 18 hours of reinforced academic activities. The second study showed that when given a choice between reinforced and non-reinforced work, the children would only choose to work on the subject area which led to reinforcement. Further, performance increased as a result of the incentives contingent upon correct responding.

Results from this project give strong support to the effectiveness of token reinforcement for academic objectives. However, the design of this study left several methodological questions unanswered. Only one group had been employed throughout these two studies. Thus, the possibility of some unidentified variable, such as teaching style or classroom conditions which had influenced the group as a whole could not be eliminated. Furthermore, teachers had frequently reported that some children performed very well in the classroom but did poorly on the criterion measures, namely the tests which are used to measure change after some experimental manipulation. The child's performance, then, did not reflect the teacher's own good efforts in helping the child to demonstrate his particular skills. Since some children did not respond as well as the teachers knew they could on these performance measures, an alternate mode of measurement was developed which was not utilized in the earlier studies. The alternative was to make correct performance on the test as meaningful as possible to the child by providing a wide variety of reinforcers for correct performance. In order to evaluate this testing approach and to control for the possible contaminating variables mentioned above, a second project was designed and implemented

during the 1969-70 school year. Twenty-four children were divided into two matched groups. The twelve children in the experimental group participated in a six-week class with token reinforcement for academic performance. The control group continued to receive standard teaching procedures in their classrooms. Results from the MRT taken at the end of the six weeks indicated that the experimental group scored significantly higher than the control group. Furthermore, when both groups were given tokens for correct performance during a second test session, the increase in score was significant and parallel for both groups. The test under standard conditions, then, was not a true reflection of the child's normal repertoire. Moreover, even with the powerful effect of the reinforcers, the control group did not reach the performance level of the group which had been exposed to reinforcement techniques.

These exciting data led to two major conclusions. First, children may not be performing at a level which adequately reflects their skills when taking a standardized test. Yet this kind of performance measure is often regarded as an accurate sample of ability and is used as a guideline in academic placement decisions. Specific steps were taken to bring motivation to a level where individual effort was optimal. Only then was the child's performance a representative measure of his academic repertoire.

Secondly, retarded children can learn material highly academic in nature, as opposed to the traditional emphasis on socially relevant self-care skills. The experimental group had been exposed to basic arithmetic and pre-reading skills during their six-week program. Coupled with a history of reinforcement for correct academic performance, this experience resulted in increased scores on the MRT posttest under standard conditions.

Dr. T. Ayllon supervised many graduate students who conducted smaller projects with individual children at Milton. While these studies were not of major importance in contributing new information, they did systematically extend the applications of these behavioral techniques to different children and to different behaviors. All of these studies taken together clearly indicated what the next step in this experimental progression would be. In August, 1970, a proposal was submitted by Dr. Ayllon which would apply the reinforcement techniques previously used at Milton Avenue School on a nine-month, school-wide basis. The design was approved by the Atlanta Public School System, and implementaion was begun in October, 1970.

Basically, the behavior modification program consisted of a major focus upon the academic components of a trainable mentally retarded curriculum coupled with systematic token reinforcement for correct performance on the academic material. In light of the previous work, there was little doubt that these objectives would be met successfully. The major questions of interest were: through what progressions would the transition be made from a traditional

single classroom orientation to a school-wide coordination of efforts; and what was the most effective method of identifying and arranging the back-up reinforcers for the tokens when the population showed such a wide range of ages, skills, interests, and abilities? And, most importantly, just how far could each individual child progress academically in such a system?

The identification of transitional procedures from a regular TMR school to a full-scale token economy was the central focus of this study. The measure selected to evaluate the effects of this new system of token reinforcement was the Metropolitan Readiness Tests. The following section includes a full description of design and implementation procedures as well as the results of this school-wide program.

EXPERIMENT I

EFFECTS OF A SCHOOL-WIDE TOKEN REINFORCEMENT PROGRAM ON STANDARDIZED TEST PERFORMANCE

METHODOLOGY

Subjects

Trainable mentally retarded children enrolled at the Milton Avenue School comprised the subject population of this program. This included children diagnosed as mongoloid, brain-damaged, and familially retarded and all others whose intelligence quotient (I Q) scores fall within the 35 to 55 point range. All pupils were included in the program, whether entering school in September or later in the year. Enrollment averaged about 130 children during the school year.

Setting

Milton Avenue School for the trainable mentally retarded was the setting of this program. All classrooms and school facilities were used in this program--including the gymnasium, the playground, the cafeteria, and the Model Apartment (used to teacher homemaking skills).

Personnel

Eight classroom teachers, 5 speciality teachers, and 18 teacher aides participated in the program. Two aides assisted each classroom teacher with one-half of the class.

Two half-time behavior research staff members, Ms. Kathleen Kelly and Ms. Dianne Bradford, were also present daily and were under the direct supervision of Dr. Ayllon. These research assistants were responsible for program implementation and special assistance to the teacher for individual children. Data collection and analysis were additional duties of the behavior research staff.

TOKEN MOTIVATIONAL PROGRAM

As described in the proposal for this program, the basic format was a token motivational system based upon principles of operant conditioning. The major aspects of this program are summarized below.

Response Definition

The educational objectives for this program were defined in performance terms, and the behaviors selected for observation and measurement were those most relevant to academic performance; namely, reading, writing, arithmetic, and language skills. These behaviors generally were written and basically were responses on mimeographed worksheets. However, in some cases, such as oral responding or blackboard work, no permanent record could be kept of the behaviors for which the children could earn tokens, since they did not fall into the category defined as academic behaviors.

Reinforcer Definition

The child could exchange his tokens earned in academic work for a variety of back-up reinforcers. A special entertainment area was set up in the gynmasium for the purpose of allowing the children to exchange their tokens for such items as books, games, puzzles, cosmetics, toys, balloons, candy and drinks, and for such activities as roller-skating, dancing, playing in kiddie cars, and riding bikes. Privileges in the classroom could also be made available with tokens. These included such activities as passing out papers, being first in line, access to certain toys in the room, visiting the principal, working in the cafeteria, and so on.

Other reinforcers which were developed during the school year included a car wash, a shoe-shine stand, and a laundry service. Supplies could be rented with the tokens, and the child could earn money through these services.

A lay-away plan was also available during the token exchange period in the gymnasium. Clothing and items donated to the school were arranged and tagged with the "token price" of each item. Once the child selected an article he would like, he would be given the remainder of that week to pay the entire "token price" and he might pay as few as one or two tokens each day. Once the full price had been paid, the child might claim the item. A full list of available reinforcers and the required tokens for their purchase is included in Table I.

Token Definition and Administration

Tokens consisted of color-coded bottle caps which were given to the child immediately upon correct completion of academic lessons. Only the teacher distributed tokens and only for correct performance on the academic activities. The aide was responsible for keeping a daily record of each child's token earnings, which were collected by the program coordinator at the end of the day.

TABLE 1

AVAILABLE REINFORCERS AND COST IN TOKENS

I. REINFORCEMENT AREA (Gymnasium)

General Store:	balloons	1	*Amusement Park:*	balloon-stomp	2
	small toys	2-3		water pistol	3
	hair ribbons	2-3		bubble blower	1
	barrettes	2			
	toy men	2			
	metal cars	3-4			
	plastic cars	2-3	*Rent-A-Toy:*	admission (includes choice of item)	2
Grooming Fun:	lipstick	1	*Band Stand:*	dancing per record	1
	fingernail polish	2		choice of record	1
	hairspray	2			
	grooming tips (4 min.)	4	*Piano Palace:*	song request	1
Refreshment Stand:	Kool-Aide	2	*Movies:*	admission	3
	small candy	1			
	large candy	2	*Marble shoot:*	5 min. play	1
Lay-A-Way::	clothing and accessories	4-15			

II. CLASSROOM REINFORCERS

playing record	1-2
being first in line	1
access to play area	1-2
going to playground	2-3

III. OTHER REINFORCERS

working in cafeteria	4-5
rental of car wash equipment	3-4
rental of shoe shine equipment	4-5
rental of laundry facilities	3-4
permission to miss activity (art, music, gym, homemaking)	2 per activity

All token exhanges were handled by the aides. A daily record was kept of each child's token exchanges, and this record was collected at the end of the day by the program coordinator.

Program Procedures

Before the initial administration of the MRT, special attention was paid to ensuring that the children knew how to take the test. Rather than penalizing their scores for a lack of familiarity with the vocabulary of testing, the children were given practice in behaviors such as "make an X," "match the ones that are alike," "draw a circle around . . ," and so on. The MRT then was administered to the entire school under standard testing conditions.

Response Priming

The initial task requirements for obtaining a reinforcer should not be so stringent that the child cannot meet the requirements and, consequently, become discouraged. Rather, the task should be divided into portions small enough that the child can perform them well and can experience the consequences of his success. Thus, the teachers were assisted by the behavior research staff in setting up criteria for each child for whatever target behaviors the teacher had specified. Initially, the requirements were low, and they were raised only when the child was able to meet those requirements. This successive approximation of target behavior was followed throughout the year each time a new task was introduced.

Reinforcer Priming

Initially, the colored bottled cap had little meaning for the majority of the children because very few of them had any previous experience with the tokens. They had no knowledge of the exchange possibilities of the tokens. Thus, the behavior research staff assisted each teacher with the introduction of the reinforcers. The children were given samples of candy, balloons, or small toys and then were asked if they would like more of these items. Predictably, the children responded affirmatively, and the teacher had appropriate worksheets ready for each child. When the children completed the requisite behavior, the teacher then gave him another candy or small toy. When this linkage was strong (from 1 trial to as many as 20 trials), a token was given contingent upon completion of the work. The token would be exchanged immediately and would in time take on the reinforcing characteristics of the candy or toys. Other times and activities in the classroom also could be acquired immediately with the tokens. For the first several weeks of the program, token exchange was conducted in the classroom following the academic period. When all classes were able to make a transitional delay, the reinforcement area was centralized

in the gymnasium for the whole school. This allowed for additional reinforcers to be made available due to space and personnel increases. (See Ayllon and Azrin, 1969, for a further discussion of these techniques.)

Each time a new reinforcer was introduced, the children were allowed to sample it free of cost. It then was incorporated into the body of reinforcers available for a certain number of tokens.

The prices of all times available in exchange for tokens were posted in the area where each item or activity was located.

Evaluation of Program

All children were given the Metropolitan Readiness Tests in alternate forms upon admission to the school and at the end of the school year. Scores from each test administration served as the critical measure of the effectiveness of the school-wide program. This particular test was selected because it is a popular, widely used measure of readiness for academic training. Furthermore, it can be administered in a relatively short period of time with a predictive validity of future performance of at least .60 for the overall test score.

During the school year, new children were continually being admitted to Milton Avenue. Thus, the initial MRT score was occasionally not administered, particularly when a child entered after December. The data analyzed in the t-test require that a child be present for both test sessions. Even a child who had been enrolled from the opening of school may miss a test session through illness. The t-test data then will reflect only a portion of the total school population. Averages for each test administration, however, reflect every test score for that test session. While some children entered school late in the year, others left Milton Avenue prior to the final testing, many being transferred to the Kennedy Cener. Thus, total averages for each test session also are presented for the reader.

In addition to the standardized testing, several analyses were made in order to demonstrate the controlling effects of the token reinforcement paradigm over academic behavior.

RESULTS

Pretest and Posttest Results

The overall school increase on the Metropolitan Readiness Tests within a period of seven months (October to May) was highly significant ($t(90)=4.672$, $p<.0005$)using a one-tailed test for repeated measures.

Number of Children	Average Increase	t Value	Significance Level
91	+4.8 raw-score points	4.672	.0005

A Wilcoxon Test of significance for differences between related measures was applied to these school-wide scores. This analysis confirmed the t-test data, stating that the two test samples were significantly different from one another ($z=2.818$, $p< .0025$).

All eight classes increased their average scores on the Metropolitan Readiness Tests between October and May. While not all of the eight classes increased to statistical significance, all averages were in a positive direction. Mean score and statistical data for each class are presented in the Appendix.

As discussed earlier, some children were present during only one of the two tests and cannot be considered in the statistical analysis. The raw average scores for all children who were present at each test session are presented below.

Number of Children	October Average	May Average	Average Change
114	35.63	41.15	35.63

A breakdown of these averages for each classroom may be found in the Appendix.

Comparisons With Previous Program (1969-1970)

The 1970-1971 program at Milton Avenue School reflected many changes over the programs of previous school years. Increased staff and number of pupils, a greater focus upon academic subject matter, and additional enrichment activities were major changes which accompanied the implementation of the token economy program. One way simultaneously to control several variables was to look at the score changes for the children who had attended Milton Avenue both this year (1970-1971) and the previous academic year (1969-1970). This comparison allowed for the effect of variation between the overall programs during each school year to be most clearly reflected. Furthermore, when only those groups of children who had the same teachers during both school years were compared, the powerful teacher variable also was held constant.

Four teachers were at Milton Avenue both academic years. Twenty-four children were present at both test sessions for both school years. During 1969-1970, the average overall change was +0.08 raw score points. This increase is not statistically significant. In fact, only one class showed an increase in its average Metropolitan Readiness Tests score while two classes actually "lost ground" and decreased their score average from the first to the second test. The fourth class showed no change at all from the beginning to the end of the school year.

In sharp contrast, during the 1970-1971 school year, these same children with their same teacher averaged 8.2 raw-score points higher at the end (than at the beginning) of the school year. The increase was highly significant ($t(23)=4.500$, $p<.0005$). Each of the four classes showed an increase, ranging from 3.25 to 15.5 raw score points on the Metropolitan Readiness Tests.

The major differences between the two school years, as discussed earlier, were all a function of the behavior modification program; namely, attention to fundamental academic behaviors, the token reinforcement system, and the specification of behavioral objectives for each child in the school. This analysis speaks most strongly for the actual effect of the program implemented during the past year. Table 2 summarizes the test data for both school years.

TABLE 2

COMPARISON OF METROPOLITAN READINESS TESTS SCORES FOR SAME CHILDREN AND SAME TEACHERS DURING TWO ACADEMIC YEARS--STATISTICAL ANALYSIS USING ONE-TAILED t-TEST FOR REPEATED MEASURES

		1969-1970 Academic Year			1970-1971 Academic Year		
Classroom Teacher	Number of Children	Average Raw Score Change	t Value	Level of Signif.	Average Raw Score Change	t Value	Level of Signif.
Moncus	8	0.00	0.00	Not Sign.	+ 7.5	2.467	.025
Senior	4	-6.0	0.774	Not Sign.	+ 3.25	0.689	Not Sign.
Hudson	6	-2.7	0.456	Not Sign.	+15.5	4.596	.005
Hatch	6	+7.0	1.285	Not Sign.	+ 7.3	2.500	.05
Total	24	+0.08	0.445	Not Sign.	+ 8.2	4.500	.005

The data from all of these test administrations were taken in the same manner. All administrations were conducted according to the directions in the test manual.

Testing With Reinforcement

An earlier research report for the Atlanta Public Schools (Ayllon, Kelly, and McCullen, 1970) indicates that the direct application of token reinforcement procedures to a test setting significantly increases test performance. Following the final administration of the Metropolitan Readiness Tests, two groups of children were selected. Whereas the study of Ayllon et.al. dealt with only a six-week experience, the 1970-1971 program provided an opportunity to evaluate the testing procedures on children who had an eight-month history of token reinforcement. One of these groups (A) had shown a significant increase in its average test score from October to May ($t(9)=2.313$, $p<.025$). The second group (B) had increased its average score, but not to a statistically significant level ($t(4)=0.322$).

All children in Group B received the alternate form of the Metropolitan Readiness Tests under reinforcement conditions with tokens given after each subtest for each correct answer. This group increased its average score by 9.6 points on the overall test. This was a statistically significant increase in raw score ($t(4)=2.030$, $p<.05$). Although the children already had a long exposure to reinforcement for academic work, still they were not performing at their peak when tested under standard conditions. When the Metropolitan Readiness Tests was given accompanied by token reinforcement, however, group performance showed a marked increase. Data for individual subjects may be found in the Appendix for both testing treatments.

GROUP B

	Tested Under Standard Conditions			Tested Under Reinforcement Conditions		
Number of Children	Test I Test-Standard Conditions	Test II Retest-Standard Conditions	Mean Change	Test I Test-Standard Conditions	Test II Retest-Reinforc. Conditions	Mean Change
5	41.4	42.8	+1.4*	42.8	52.4	+9.6**

*Not Significant
**Significant at the .05 level.

Group A, as noted earlier, had already improved its average score over the school year, with an overall increase of 6.0 points. The group was selected on this basis to determine if the children's test performance could be increased even further. Although their score improvement under standard testing conditions was significant, the data from the earlier study suggested that further progress might be possible when reinforcement techniques were applied. When the alternate form of the Metropoltian Readiness Tests was administered under maximal reinforcement conditions (all reinforcers visible during the test), the average score increase was only 0.20 points, not a statistically significant change (t(9)=0.1296).

GROUP A

	Tested Under Standard Conditions			Tested Under Reinforcement Conditions		
Number of Children	Test I Test-Standard Conditions	Test II Retest-Standard Conditions	Mean Change	Test I Test-Standard Conditions	Test II Retest-Reinforc. Conditions	Mean Change
10	43.6	49.6	+6.0**	49.6	49.8	+0.2*

*Not Significant
**Significant at the .05 level.

While this particular group of children did not replicate the results of Group B and the earlier study, it did demonstrate that even in a period of a few months the teacher herself can acquire the functional properties of the extrinsic reinforcers. The scores for each child can be found in the Appendix.

DISCUSSION

Experiment I led to several major conclusions regarding the 1970-1971 behavior modification program. Pretest and posttest data indicated that some significant variable was introduced which was reflected in the dramatic improvement on the MRT. This effect was not due simply to a difference in school population; comparison test data for the same children under the 1969-1970 and 1970-1971

program demonstrated a significant difference between the two school years' test scores. Furthermore, when the variable of classroom teacher effect was controlled, the same results were obtained. Moreover, in all comparisons, the 1970-1971 program produced better results than the previous year, and the change was not due to new children or to new teachers.

Testing with reinforcement versus standard test procedures provided additional information. One class showed a significant increase when tokens were contingent upon correct responding. Another class, however, did not show this improvement. During the previous school year, the latter class had shown no change whatever between the two Metropolitan Readiness Tests measures. Throughout this year, however, the same teacher was paired with tokens and their backup reinforcers together, accompanied by her own unique social reinforcers. This teacher was known for her skillful use of social reinforcement in the classroom. Indeed, her own efforts to promote correct responding in all phases of her academic program resulted in such consistent use of reinforcement that she herself acquired some of the reinforcing characteristics of the tokens. The actual presence of the token could not further augment performance beyond the high level of motivation to which she had already successfully brought the children. Moreover, the class seemed to have reached a ceiling in its performance level, so that the addition of more social reinforcement, or even the backup reinforcers themselves, could not produce behavior which was not already present in the children.

At the end of Experiment I, many unanswered questions remained concerning the 1970-71 program. A major change had been produced identified. Several potential change agents had been eliminated as possible major effects in Experiment I, including teacher effect and the increased enrollment, thus changing the pupil population. Furthermore, the specific role of the token reinforcement system had not been investigated. More explicit statements of the token system were needed if the following critical question was to be answered: What indeed was the critical variable which had led to the results in Experiment I? In an effort to answer this question, Experiment II was designed and undertaken. This investigation, it was hoped, would fill some of the gaps in the analysis of the Token Reinforcement Program. Accordingly, it was hoped that Experiment II would specify some of the critical dimensions of the reinforcement contingency in the TMR setting.

EXPERIMENT II

THE EFFECT OF NON-CONTINGENT DELIVERY OF REINFORCEMENT ON ACADEMIC PERFORMANCE

The previous study had eliminated all but one of the variables which could possibly have effected the dramatic MRT scores in the 1970-1971 program. A functional analysis of that final factor, the behavior modification program, would be needed in order to demonstrate that token reinforcement did indeed effect the improved test scores. Such an investigation is not feasible with a large number of children nor is a large group necessary to demonstrate the effect of the intervention. Several questions needed to be answered regarding the Token Reinforcement Program before a statement could be made as to its effectiveness. Experiment I was designed to begin this investigation. Several components were already known from earlier reports to be critical in the increase of academic performance. (1) The child had to perform some (2) behavior which (3) was followed by a reinforcing event, in this case, the token. The presence of each of these three components was necessary for effective academic functioning, but were there additional considerations to be explored? The operant literature has repeatedly shown that when reinforcement is delivered before a behavior is emitted, the target behavior weakens or even ceases to be emitted. The purpose of Experiment I was to investigate the effects of non-contingent delivery of tokens with a group of trainable retarded children.

METHODOLOGY

Subjects

Three trainable retarded children were the subjects of this study. They ranged in age from 8 to 13 years.

Setting

One of the classrooms at the Milton Avenue School was used for this study. All sessions were conducted in the same room at the same time each day. A regular staff member of the school conducted the procedures.

Response Definition

All children were given a number of prepared worksheets each day in three subject areas: mathematics (simple adding and subtracting), writing (writing words and sentences from a sample), and copying (drawing figures and shapes from a sample). These sheets were designed so that each item in all three areas was roughly equivalent in time to complete and level of difficulty. Sample sheets from each subject area are included in the Appendix.

Peinforcer Definition

All the children were familiar with the system of token reinforcement for academic work. This conditioned reinforcer was available contingent upon correct answering of the worksheet items. At the end of each session, the children were able to exchange their tokens in a room designed for that function.

Procedures

For the first six sessions, all children were given their work sheets and a timer was set for a certain period of time. Mathematics sessions were 15 minutes long, and copying and writing sessions were 10 minutes each. When the timer rang, the papers were graded, tokens were distributed, and the papers were collected. Each subject area followed this same schedule. A daily record was made of the performance of each child by subject area. A baseline of these children's mathematics performance under reinforcement conditions was thus established.

Next, reinforcement not contingent on academic performance was initiated. This consisted of distributing the usual number of tokens earned by the children before they began their work. Mathematics was the subject area selected for this manipulation. Work sheets were distributed as usual, but instead of waiting until the timer had rung and the papers were graded, the children were given their tokens for mathematics just before the timer was set. This procedure was followed during six sessions. Finally, reinforcement contingent on performance was reinstated. Again, tokens were given to each child only upon completion of his work. When the timer rang, the papers were graded and collected, and tokens were given only for work completed correctly. The numbers of items correct and incorrect were calculated for each child in each subject. Rate per minute was also determined under all three conditions.

RESULTS

Deliver of tokens noncontingently with respect to the target behavior decreased the rate of correct responses per minute and, in some cases, increased the rate of incorrect responses.

Table 3 shows the effect of giving the tokens to the child prior to the emission of the behaviors. In all three cases, such procedure led to a reduction in the rate per minute for mathematics. However, when the reinforcement contingencies were reinstated, the mathematics rate rose to the baseline level or above.

Correct responses in writing showed relatively no effect. Even though the contingency for mathematics responses was manipulated, the delivery of tokens for writing performance remained the same throughout. Performance in writing, therefore, relatively stable over all 3 conditions.

An additional way to evaluate the effect of these manipulations is to calculate the average responses (correct and incorrect) for the mathematics over the sessions under each of the three conditions. These data present immediate information which may be more readily seen than the rates alone. Table 3 also presents this information for each group.

TABLE 3

AVERAGE NUMBER OF CORRECT AND INCORRECT MATHEMATICS RESPONSES PER SESSION

		Reinforcement Condition		
Name	Math. Response	Contingent	Non-Contingent	Contingent
Marie (S#1)	Correct	24.3	5.2	32.2
	Incorrect	2.2	0.16	0.12
William (S#2)	Correct	11.1	1.6	10.2
	Incorrect	8.8	12.3	0.3
Jeffery (S#3)	Correct	9.1	1.2	11.4
	Incorrect	8.3	6.3	0.7

While this information is simply the translation of the responses-per-minute data, this is a more direct presentation in the terms with which the educator is most concerned, namely performance within a given period of time.

DISCUSSION

Timing is a critical variable in the delivery of reinforcement, as shown in Experiment II. Furthermore, academic performance could be directly varied by the reinforcement contingency in effect when the behavior is to be emitted. One question had thus been answered regarding academic performance and the behavior modification program: the dramatic performance increases would have been unlikely, if not impossible, if contingencies had not been carefully arranged. Attention to this small, but very important, link in the behavioral chain was thus one factor in the success of the 1970-1971 program.

Several questions remained unanswered after Experiment II. One of these questions was how powerful was the behavioral program in producing academic behavior? Would not retarded children reach a ceiling very soon in daily performance? Experiment I had partially investigated this question, using the MRT as the dependent variable. No functional analysis was possible with this design, however, so the data were insufficient for this intense experimental study. In order better to analyze the control of the motivational system, a daily record of academic performance would be the optimal measure. Experiment III, then, was designed to use daily measures of behavior with a change in the behavior-reinforcement ratio. This would be a severe test for the reinforcement paradigm, for this experimental manipulation has not yet been reported with trainable retarded children. The ratio change is complex, even for normal children; accordingly, for a group of children who are slow, have short attention spans, and who are not expected to perform well in any academic area, an attempt to measure performance change would seem to be rather futile.

EXPERIMENT III

EFFECT OF MULTIPLE RATIO'S FOR REINFORCEMENT ON ACADEMIC PERFORMANCE RATE

The previous study answered the critical question regarding the delivery of the reinforcer and the actual completion of a required task. The requirements for reinforcement had remained constant throughout the study while the contingency of delivery of the token had been altered. In this study, the required behaviors leading to reinforcement were manipulated in order to determine if retarded children could respond to adjusted behavioral requirements.

Subjects

Three trainable mentally retarded children originally participated in this study. Their age range was 8 to 10 years old. One child was eliminated from the data when his attendance rate did not reach 80 per cent. Thus, data are presented only for the remaining two children.

The setting, response definition, and reinforcer definition were the same for this group as in Experiment II.

Procedures

As in Experiment II, these children were given six timed baseline sessions. Mathematics sessions were 15 minutes in length, and copying sessions were 10 minutes each. The numbers of correct and incorrect responses per minute were computed and recorded for each child. The ratio of responses for tokens earned during the baseline period was as follows:

Mathematics: 10 correct items = 1 token.
Copying: 15 correct items = 1 token.

Following these six baseline sessions, Condition II was introduced. The two children were given an adjusted scale of multiple ratios by which their number of tokens earned in mathematics would be calculated. These ratio bands, based on each subject's performance rate during the baseline period (Condition I), were as follows:

S #4 MATHEMATICS

1) no tokens for 0-15 correct items
2) 1 token for 16-20 correct items
3) 2 tokens for 21-28 correct items
4) 3 tokens for 29-34 correct items

S #5 - MATHEMATICS

1) no tokens for O-19 correct items
2) 1 token for 20-27 correct items
3) 2 tokens for 28-32 correct items
4) 3 tokens for 33-36 correct items

A card was made for each child which stated the ratio system for him. Six sessions were conducted with these multiple ratios for mathematics only in Condition II. Following Session 12, the original ratio system was reinstated in Condition III. Papers were graded and collected as usual with the appropriate number of tokens given to each child. Correct and incorrect responses per minute were calculated under all conditions.

RESULTS

Implementation of a multiple ratio of token reinforcement served to augment performance weel beyond baseline levels where "richer" schedules were in effect. When the child's minimum performance requirement was raised, not only did his correct responses increase, but further, the incorrect responses per minute decreased. A reinstatement of the original ratio system (lowered requirements for reinforcement) returned performance rates approximately to baseline rates. The figures show a direct relationship between actual work output and the stated requirements for earning reinforcement. Table 4 is included here to given the reader an additional view of the results of the experimental manipulations. In it average correct and incorrect responses per session are given for all 3 conditions.

TABLE 4

AVERAGE NUMBER OF CORRECT AND INCORRECT RESPONSES PER MATHEMATICS SESSION

Name		Condition: Single Ratio	Multiple Ratios	Single Ratios
Tony (S#4)	C	24.4	41.1	27.7
	I	5.5	0.9	3.7
Frankie (S#5)	C	13.3	21.4	8.3
	I	4.2	0.5	1.7

DISCUSSION

The stating of behavioral requirements for a specific consequence can directly affect performance. Thus, what appears to be a simple concept is, in reality, a rich source of further analysis and experimental investigation.

An analysis of the progressive increase in the complexity of the work sheets offers an additional dimension for evaluation of the procedures. In mathematics, for example, the children initially were able to do only simple addition with sums of nine or less. At the end of this study, they were able to add columns of two or three numbers with sums up to twelve. Also, simple subtraction was done by all the children with one child being able to subtract a one-digit number from a simple two-digit number. Writing evolved from simple copying of words on a mimeographed sheet to copying words and sentences from the blackboard on lined paper. Copying shapes originally included only straight lines and circles with very few diagonal lines. By the end of the study, the children were able to copy complex shapes and figures with many sloping lines and irregular shapes.

Experiment III had greatly extended the applicability of reinforcement techniques with TMR children. The implications of this study are not only exciting, but also provocative in terms of the actual behavior output as a function of the stated requirements (expectancy?) of the teacher. It was found that a great amount of variability could be effected within the same time period by adjusting the requirements for a specified consequence. The next question to be asked was what would happen if the requirements were held constant

and the available work time was manipulated? This particular intervention seemed somewhat precarious when one considers the literature regarding decreased available time for reinforcement. Emotional behavior is typically the consequence of such a punishment intervention. With severely retarded children, the same results were not unlikely to result from any decrease in available work time. Nevertheless, certain questions needed to be answered regarding the behavior modification program. Any data that could add further information regarding the control of the reinforcement techniques would be gathered. In an effort experimentally to investigate the effect of adjusted work time reinforcement consequences, Experiment IV was implemented.

EXPERIMENT IV

EFFECT OF ADJUSTED AVAILABLE WORK TIME INTERVALS ON PERFORMANCE RATE FOR 2 ACADEMIC BEHAVIORS

The following study was an outgrowth of Experiment III and again deals with academic response rates. In the previous study, the requirements for reinforcement were manipulated, and the resulting effect upon rate was measured as the dependent variable. In this study, on the other hand, the behavioral requirements for reinforcement remained constant, and the work time available was experimentally manipulated.

METHODOLOGY

Subjects

Five trainable mentally retarded children took part in this study. Their age range was 9 to 12 years.

Setting

A regular classroom was used for this study. All sessions were conducted there under the direction of the classroom teacher.

Response Definition

The units of behavior specified as the responses for this study consisted of two academic subject areas, arithmetic and writing.

Arithmetic The children had available as many mimeographed work sheets as they could finish during each timed session. Since the children were functioning on different performance levels, the requirements for each child varied. The breakdown of the criteria for each child was as follows:

Donita and Hornethia - 10 problems per page, adding sums to 10.
Sylvia - 10 problems per page, adding sums to 6
Jarswin and A.V. - 6 to 10 problems per page, counting figures and selecting the correct answer from a choice of six numbers.

There were between ten and twenty different work sheets per child. No child did the same sheet twice during a session. Work sheets were similar to those already included in this report (see Experiment II).

Writing

Again, each child had access to as many sheets as he could finish in a session. All children received the same work sheets. There were lO words per sheet which the children were to copy.

Reinforcer Definition

Tokens earned in this work could be exchanged for a variety of backup reinforcers such as candy, Kool-Aid, small toys and trinkets, going outside to play, and free time in the classroom. The children received one token for each correct page of work at the end of each session. Token exchange took place each day after all sessions had been run.

All five children had been in the full-scale token economy program for six months. They understood the relationships between the academic work and the tokens and between the tokens and their backup reinforcers. Thus, no priming was conducted.

Procedures

Each day the children were given the two sets of academic materials from which they were instructed to complete as much as they were able to do within the time allowed.

At least one session each of arithmetic and writing was held daily. The children received the following instructions prior to each session: "Do as many sheets as you can before the timer goes off." Then the teacher set the timer. Initially, the timer was set for 15 minutes. Later, several times intervals were explored: 7 minutes, 3 minutes, and finally 1 minute. An A-B-A experimental design was included to determine the relationship between specified temporal requirements and the children's academic performance. That is to say, a baseline of academic performance was obtained under a specified time limit. This time limit was drastically reduced, and then the effects of this reduction on academic performance were observed. Finally, a return to the initial baseline conditions allowed a functional analysis of these procedures.

Prior to the first 15-minute session, the teacher explained to the children that they were to be given a certain number of pages of work to do. She set a timer that would ring after 7 minutes and then would be reset to ring after 8 minutes. The children were instructed to continue working, regardless

of the bell, until she told them to stop. This procedure was followed in order to reduce the novelty effect of the timer, since it was the first time the timer had been used in this classroom. The teacher told the children to do as much work as they could before she told them to stop. Eight sessions for each behavior were run under this condition. During these sessions, the numbers of correct and incorrect responses per minute were recorded for each child for each behavior. After the baseline period, session lengths were cut to 7 minutes. Ten sessions were run on this time interval for each behavior. Next, 4 sessions were taken under a return to a 15-minute session length. Then, 7 sessions were run for 3 minutes in length followed by 4 sessions of one minute in length. Lastly, 4 sessions of 3 minutes each were run. During all sessions throughout this study, the numbers of correct and incorrect respones for each child and each subject area were recorded. The bell was rung only once during the intervals following the first 15-minute sessions. The children were told to stop when the bell rang.

RESULTS

When, after a baseline period, the available work time is sharply decreased, the rate of correct responding increases significantly from baseline rates. Moreover, when the original available work time is reinstated, the rate of correct responding does not return to the baseline rate, but in some cases, surprasses the rate of responding during the intervening abbreviated session.

Table 5 gives the average rate for correct responses per child for each session. There is a definite effect across all subjects when the available time is reduced. Furthermore, in several cases, when the baseline conditions were once again imposed, the accelerated response rate increased even further. Thus in several instances, the increased performance rate could be said to be irreversible under these conditions.

TABLE 5

AVERAGE CORRECT RESPONSE RATE
PER MINUTE UNDER EACH TIMING CONDITION

Writing

Name	Baseline I 15'	Abbreviated Session I 7'	Return to Baseline I 15'	Baseline II 3'	Abbreviated Session II 1'	Return to Baseline 3'
Sylvia	3.45	4.89	6.75	7.97	9.50	10.22*
Donita	2.68	3.41	4.27	4.50	9.00	9.15*
Hornethia	3.03	4.37	4.57	6.38	8.50*	6.73
A. V.	2.04	3.64	3.80	4.68	6.25*	6.22
Josh	2.00	2.40	2.95	3.52	4.25*	4.12
Average	2.64	3.74	4.47	5.41	7.50*	7.29

Arithmetic

Name	Baseline I 15'	Abbreviated Session I 7'	Return to Baseline I 15'	Baseline II 3'	Abbreviated Session II 1'	Return to Baseline 3'
Sylvia	2.12	3.03	3.50	3.82	5.75*	5.30
Donita	2.57	3.52	4.27	4.51	5.00	5.47*
Hornethia	1.73	1.98	2.85	3.50	4.00*	3.75
A. V.	0.37	0.42	1.35*	1.00	0.75	1.87
Josh	0.36	0.98	1.10	1.17	1.50	2.25*
Average	1.43	1.99	2.61	2.80	3.40	3.72*

*Rate increased steadily to this point.

Since the trends were uniform across all five subjects, the data for each subject area can be presented in group form. Figures 1 and 2 show the average correct and incorrect responses for both arithmetic and writing. (See pages 27 and 28.)

One point of interest regards incorrect response rate. For three of the children, the rate of correct responses remained near zero, even under the pressure of the one-minute timed session. The two remaining children showed extreme variability in their error rates. Both of these children, it should be noted, are under heavy medication and are also considered by a physician to be severely emotionally disturbed.

DISCUSSION

There are several possible explanations for the continued performance increase in all sessions following the initial baseline. One could hypothesize that since each interval change maintained the increasing rate per minute that perhaps a Hawthorne effect was being produced. This effect refers to a situation where almost any change leads to increased production or performance.

A more likely explanation is suggested by an analogous punishment paradigm. Azrin, Holz, and Hake (1963) noted that the manner of introduction of a punishing stimulus (in this study, the analogous counterpart is reduced time) is critical in its effect upon on-going rate. A high voltage shock (80 volts or more) would suppress responding completely if suddenly introduced. However, the voltage is initially lower and is gradually increased, they found that performance could be maintained at intensities as high as 130 volts.

Coupling this experimental data with a schedule which produces high rates of behavior (fixed ratio), the results are less surprising. A sudden introduction of the one-minute session following the 15-minute baseline would predictably effect a complete suppression of responding. The gradual reduction in length of sessions, however, allowed the response rate to make smaller increases until the one-minute session was introduced. Minor behavioral outbursts occurred, but the performance did not decrease or break down.

As referred to earlier, the subjects had been exposed to a token economy, but during the experiment, the subjects became acutely aware of the following variables: number of tokens they and the others had, specific limits on work time, and a transfer of control of work time from the teacher to the

FIGURE 1

WRITING - CORRECT AND INCORRECT RESPONSES DURING VARIOUS (SUCCESSIVE) TIMER PERIODS

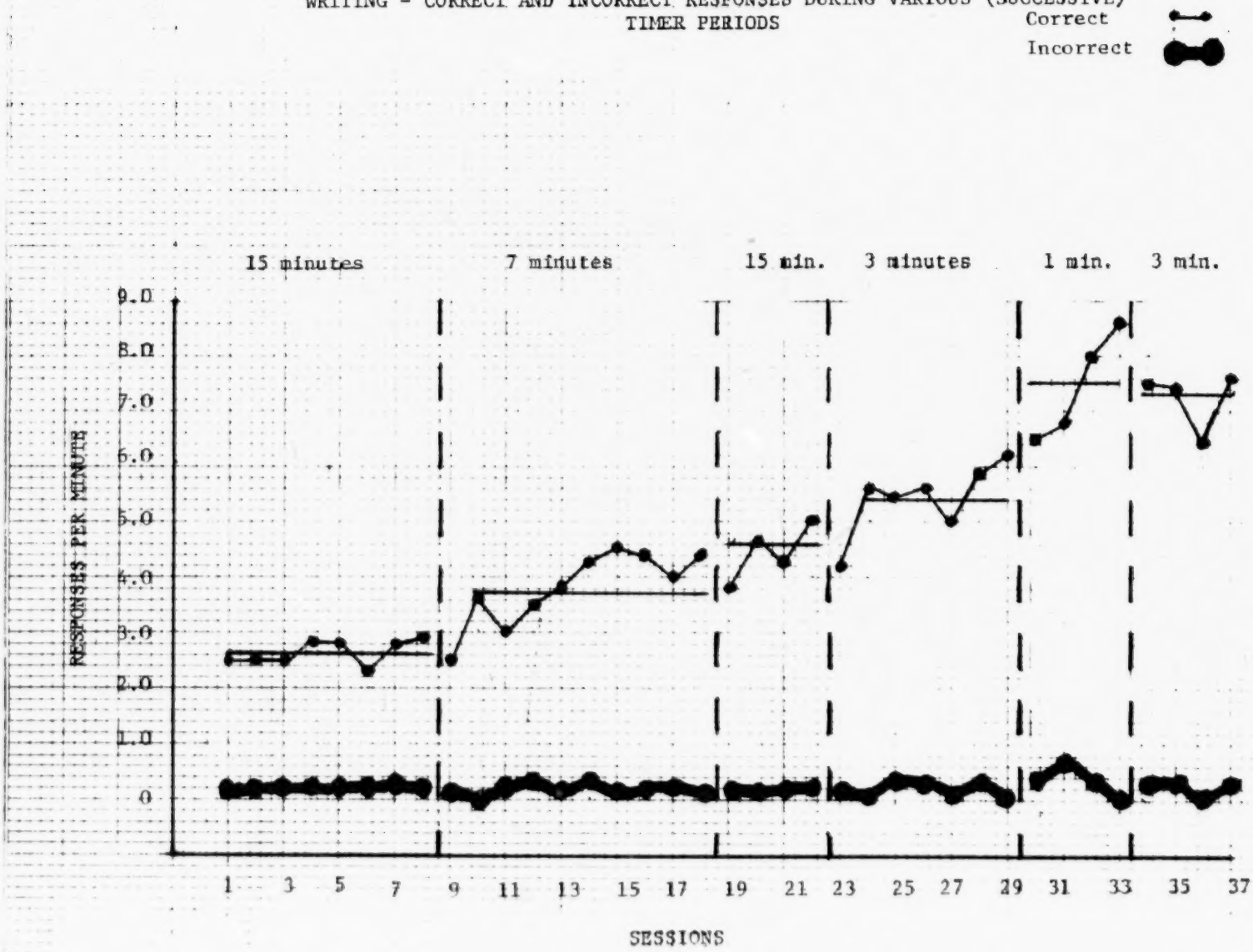
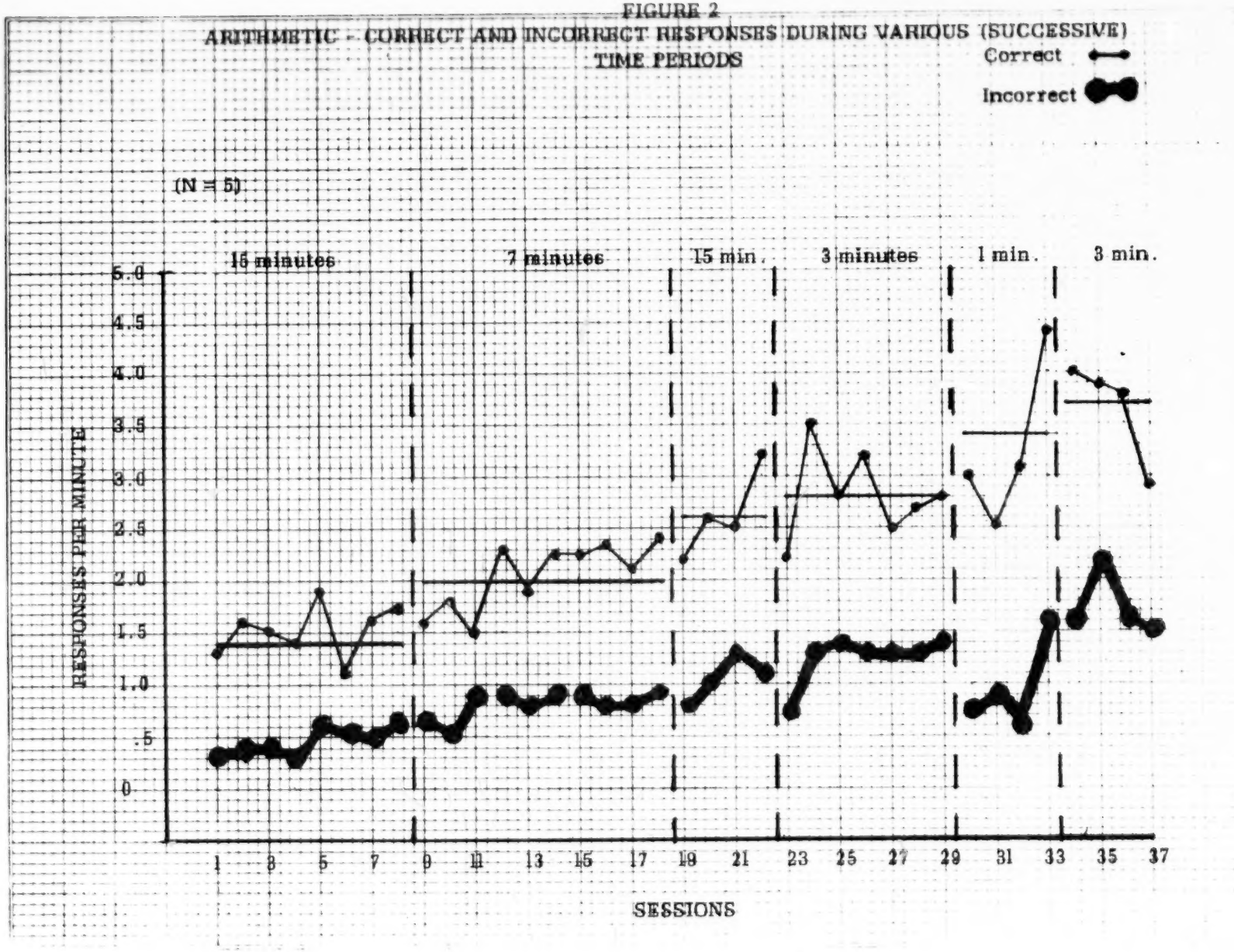


FIGURE 2


ARITHMETIC - CORRECT AND INCORRECT RESPONSES DURING VARIOUS (SUCCESSIVE) TIME PERIODS
Correct
Incorrect
(N = 5)
15 minutes
7 minutes
15 min.
3 minutes
1 min.
3 min.
RESPONSES PER MINUTE
6.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
SESSIONS

kitchen timer. One example of this new awareness was the bargaining power the token acquired, not only did the children become competitive and compare total earnings before spending them, but during token exchange, the children would by and sell to each other at profit-making prices. Although these children were used to working at their own pace within a more leisurely one-hour period, within the first two sessions they responded to the bell by promptly putting pencils down and collecting their completed work. One interesting demonstration of the power of the timer had occurred during the one-minute interval session. After the bell went off ending the second one-minute session, the pupils stopped and directly threw their pencils at the timer and one pupil verbally abused the timer (by calling it a "four-eyed dog"). Although this class was formerly the most disruptive class in the school, this was the only time disruptive behavior occurred during the entire experiment. It should be noted that two pupils demonstrated their frustration by refusing to work during the third session of the one-minute interval, but renewed their participation for the fourth session.

The four experiments to date had added much support to the view that the behavior modification program was indeed the factor which effected the tremendous MRT score increases. The final step in the program, then, was systematically to apply these techniques in an effort to achieve a specific goal. The objective of this final effort was to determine if a short-term program using token reinforcement would be effective in identifying those children who could function well in an EMR setting. Success would be measured in social and behavioral ways as well as in terms of academic ability.

EXPERIMENT V

A FIVE-WEEK PROGRAM FOR TMR CHILDREN WITH EMR OBJECTIVES

The following advantages for a child in an EMR class are obvious: greater emphasis on academics, social contact with normal children, and participation in activities which more closely approximate those available in the community. It was with these considerations in mind that the following five-week undertaking was designed and implemented. The objectives of the Behavior Research Staff were to stimulate as far as possible the conditions in a typical EMR classroom in order to determine if the child could do reasonably well there. Academic requirements, then, were paced to the EMR level. Furthermore, any social or behavioral problem which arose in this classroom arrangement would be indicative of adjustment problems in a new school. If, however, the child could function along all three dimensions, there would be serious doubt as to the feasibility of his staying any longer in a TMR setting.

METHODOLOGY

Selection of Children. Each teacher was asked to submit the names of those children whom she regarded as the best candidates from her classroom for transfer to an EMR classroom. This meant those children whom she felt would most benefit from an experience in an EMR setting. These names were then reviewed by the principal, Mrs. Paula Calhoun, and by the Behavior Research Staff. Fourteen children were selected. Only 11 children completed the program. One child was judged inappropriate for transfer to the class because of immature behaviors; the other two children were dropped from the class of repeated absences, which exceeded the required 80 per cent attendance rate.

Personnel and Setting. One of the teachers had prior experience teaching in an EMR classroom, and she expressed an interest in conducting this class. Since several pupils from her morning group were on the final roll for the program, it was decided that her classroom would be used. In addition to her regular teacher aide, one of the project research assistants was present to assist her during the daily academic period.

Length of Program. This pre-EMR program lasted for five weeks. The children, who were from several classrooms, met as a group each morning during the academic period (9:30 - 11:00). At 11:00 they returned to their own classrooms and went to token exchange with their own classes. Lunch and special activities were not affected by this program.

Program Objectives. The basic goals of this class were to prepare the children for the kinds of behaviors which would be expected of them in an EMR classroom. To specify these behaviors, various TMR programs were investigated with the view that when all of those objectives were met, the child would be ready for the next academic step, namely the EMR class. Additionally, the goals and objectives of the EMR class were explored. None of these investigations proved satisfactory in settling the question of what were to be the specific objectives, in academic behavioral terms, of our efforts in this class. The solution to this dilemma was the construction of a checklist based on the available sources. There was much overlap between TMR and EMR curricula guides, so the final checklist consisted of the following two levels of difficulty: a primary and an intermediate level. The three areas of academic focus were phonics, arithmetic, and social skills.

The objectives of the class were to enable the child to be proficient in as many areas as possible within the five-week period. Concerted focus upon specific behaviors which were necessary for the EMR child was deemed the method which would be most effective in achieving these objectives. A copy of the checklist is included in the Appendix.

Program Evaluation. All children were given the checklist before and after the program. Changes over the five-week period would reflect the child's ability to function and to progress in an academic program with EMR material. This checklist was most useful, however, not as a measure of performance change, but rather as a diagnostic tool. At the beginning of the program, feedback from the checklist facilitated grouping for the three subject areas by delineating specific abilities and weaknesses. At the end of the program, it provided a profile for the school officials to use in conjunction with other data to determine if the child would actually be assigned to an EMR class. Since these checklists were not standardized and were, in fact, syntheses of other lists of behaviors, a statistical analysis of change is not appropriate.

An attempt was made to specify standardized tests which would be used to provide an additional measure of progress over the five-week period. After talking at length with several people from the Instructional Services Center of the Atlanta Public Schools, it was found that only pre-reading (phonics) skills could be evaluated in this program. The Comprehensive Instructional Program (CIP) Reading Skills Test was suggested for use in both of its first grade level forms (beginning and end of first grade). These two forms of the test were given before and after the five-week program. Statistical evaluation could be made of these measures.

The critical evaluation, in the final analysis, was whether or not the child had the prerequisite behaviors to enter and to perform in an EMR class. This could be determined in the two following steps: first, successful completion of those steps leading to actual admission to the classroom and, second, actual classroom performance in an on-going academic program.

Program Format. Based on the feedback from the checklists coupled with the first reading test results, the children were divided into two basic groups. Arithmetic and language arts (phonics) were taught on a primary and on an intermediate level to correspond with the objectives in the checklists. The Science Research Associates (SRA) Basic Reading Series was used for language training. Training in social skills was conducted in one large group.

Program Content. All academic target behaviors were drawn from the checklists. A breakdown of these behavors into specific subject areas follows:

Arithmetic (Primary) Counting, simple addition (sums to 19), and simple subtraction (no borrowing) on ditto sheets were available each day during a 15-minute period. Unlimited numbers of work sheets were available to the children following instructions for that period.

Arithmetic (Intermediate) Addition with carrying, subtraction with borrowing, and basic fractions were also presented on ditto sheets. These were available during approximately 30 minutes each day.

Language Arts (Primary) Alphabet and beginning phonics (initial sounds) were the focus for this group. Pre-primer work books were used for written exercises in addition to oral quizzes. This period lasted about 30 minutes.

Language Arts (Intermediate) Complex phonetic structures--including blends, diagraphs, and dipthongs. Oral and written exercises were conducted during about 30 minutes daily.

Social Skills All children participated in role-playing exercises and discussions of social problem situations. Twenty to 30 minutes daily were spent in these activities.

RESULTS

All eleven children reached a proficiency level of at least 35 per cent of the total checklist items completed correctly at the end of the five-week program. Several children could perform far more than 35 per cent of the 192 checklist items. This means that they could perform at a level sufficient to meet EMR requirements for mathematics, social skills, and language arts. The numbers of items in which the children improved ranged from 10 to 28 items. This gives a mean of 22 items which could not be done consistently at the beginning of the program but which performed well at the end of the five weeks.

Reading test scores also increased significantly. On both forms of the test, the group showed an increase which was significant at the .10 level: Test I, $t(10)=1.6588$; Test II, $t(9)=1.463$. The average raw score increase was 2.4 points for Test I and 6.0 points for Test II.

Eight of the eleven children completing the class were recommended and screened for EMR classes and their teacher visited the prospective classroom in the regular school. This satisfies the first part of the two-step requirement for a successful EMR experience. A follow-up will be done on each child after the 1972-73 school year has begun. Two of the remaining three children were considered too old for transfer to an EMR class (ages 14 and 15 years). These children will continue at Milton Avenue School until they are old enough for admission to a sheltered workshop or vocational training setting. The third child was considered a high risk for successful EMR functioning because of his low level of verbal skill development. Accordingly, it was decided that an additional year at Milton Avenue School with emphasis in this area would be a better placement decision. Entry into an EMR class with inadequate verbal skills, even though the child is well prepared academically, could be a serious error which might affect the future of the child in the school. A fourth child is eligible for entry into an EMR class, but transportation problems make it impossible for him to leave Milton Avenue School to go to a regular school.

DISCUSSION

Children are placed in a trainable mentally retarded setting for many different reasons. Some of these factors are organic and cannot be altered. Other variables stem from the social environment and may be so long-standing as to be irremediable. Still others may be placed in a TMR setting, originally on a temporary or trail basis, and may find themselves adjusting to a setting

which demands less than they are actually capable of doing. This placement error is due to the lack of truly effective diagnostic tools which are reliable and clear-cut. No teacher of the trainably retarded can identify everyone of those children who may fall into this category. Her time is too expensive to donate completely to one or to several children, and this unfortunate situation is not improving in terms of pupil-teacher ratios.

Seven children will move from one TMR setting as a result of an intensive five-week program. During 90 minutes each day, the class was exposed to the same material which they would be expected to learn in the regular school setting. Coupled with a token reinforcement system, these children were provided with a rich academic experience, but one that is within the reach of any classroom teacher. Perhaps a belief that these children were "brighter" enabled the teacher to push them further and further into material that supposedly was beyond the ability of a TMR child. Indeed, another experiment included in this report suggested that the child adjusts himself to the behavioral requirements of the environment (see Experiment III). What is important, though, is that the children succeeded. As each step was mastered, the next step was clearly stated. The checklist was a most valuable tool in this study. It is unfortunate that no tools were available to give such information as grade level or an even more sensitive index of progress. The critical test, nonetheless, had been passed. Seven children were preparing to enter a setting more in keeping with their abilities. The more difficult task of maintaining performance in that environment will be the "acid test" for both the child and the academic environment.

The next step in a program such as this one would be the use of contracts between the teacher and pupil. The checklist provides specified levels, so that when one behavior is completed the next step is clearly stated. Translating these requirements into a behavioral contract would be a simple matter. These children are capable of working in a contract-type framework, and furthermore, they are very interested in their own progress when the requirements for advancement are clearly specified. This interest can be seen in the following events which occurred during the EMR program: The teacher was completing the post-program checklist measures for one boy while he was responding at her desk. Looking down his own checklist, he saw many "checks," indicating correct performance, and one"X," which meant he could not perform that behavior. He asked the teacher to which behavior that "X" referred, and she replied that it was for the months of the year. During several days following, the boy sought assistance from the teacher and aides until he could recite the months perfectly. Triumphantly, he watched as the teacher erased the "X" and placed a "check" for the final behavior on the list. He knew exactly what he had to learn to get his "check," and, furthermore, he believed that he could do it. The final ingredient was his motivation to put forth the effort, and the goal of a perfect checklist sheet provided that incentive.

GENERAL DISCUSSION

This report has been the culmination of three years of work at Milton Avenue School, and it represents the most extensive application of behavioral techniques at that school. Previous studies dealt with smaller groups on a short-term basis. This project involved the whole school during an entire school year, and it has served to confirm and to extend further the previous results. The experiments conducted during the program suggest various methods by which teachers themselves can alter behavior. The techniques are described well and can be easily implemented by any classroom teacher or teacher aide. In short, the Behavior Modification Program which was conducted this year is the most intensive type of inservice training available. The general dimensions of possible extensions of behavioral techniques have approached their useful limits in this setting. Many issues and analyses have been explored in the framework of this and earlier studies. The most fruitful and relevant behavioral applications will now proceed vertically, that is, into more intense explorations of already confirmed techniques rather than into totally new areas of application.

Before concluding this report, there are two remaining items of importance which should be noted. These topics include a discussion of the Inventory which was used by all teachers at Milton Avenue and a discussion of the role played by Milton Avenue this year as a demonstration school in the use of behavioral techniques.

The Inventory is a group of checklists consisting of over 750 items which the teacher gives to each child in her class at the beginning and at the end of the school year. An additional use was made of the Inventory for the program. After the initial administration of the items to each child in her class, the teacher was asked to select those items which would serve as the child's goals for the year. Each teacher was free to specify as few or as many goals as she felt were feasible for the nine-month period. The final tally ranged from 4 to 39 goals or more for an individual child.

The purpose of stating objectives explicitly was to emphasize the accountability aspect of the teaching profession. By clearly outlining toward what objective she wanted to focus her efforts, the teacher also was specifying those channels which would best reflect her efforts. A worksheet was designed by the Behavior Research Staff which enabled the teacher to make periodic checks on her progress. Each item could be rated as either "Yes," "No," or "Progressing but still weak" by a specific symbol. After the final evaluation the number of items which were rated as "yes" were divided by the total number of goals set for the year. A ratio of successfully reached items was determined. For the children, the range was from 40 per cent to 100 per cent of the total items achieved. The average for all children was 69.0 per cent items achieved.

When asked about their use of the Inventory to set objectives, the teachers over-whelmingly approved of this system. They stated, in addition, that they planned to use specified objectives again next year, for this gave them an on-going feedback system of their own progress toward those goals. They were also free to alter their stated objectives into smaller units whenever necessary. Rather than relying on less precise indices of change, the teachers preferred to know exactly what academic tasks they would focus upon for each child and how they would evaluate these efforts for themselves and for the child.

Milton Avenue School is unique in that it is the only special education school in this area in which a major emphasis is being placed on behavioral techniques. Thus, in this capacity, it has served as a demonstration school for pupils and professionals who are interested in seeing how a program conducted with behavioral techniques would actually look. Over 175 people visited Milton Avenue School this year, both as individuals and as members of groups. Many of these groups were graduate Special Education classes, but visitors often came to Milton Avenue to observe specific techniques. For example, one professional from the Atlanta Public Schools wanted to know specifically how disruption and destruction were treated. These problems, however, simply did not exist at Milton Avenue, since the competing constructive behaviors, which were being reinforced daily, kept disruption from being a problem.

Moreover, the entire Milton Avenue staff has performed a very valuable service to the Atlanta Public Schools. More powerfully than any testbook or film, these teachers and aides demonstrated daily the use of a behavioral technology which is within the range of all school personnel. Furthermore, they showed clearly that what had been written on paper could be accomplished smoothly and successfully. Through their unique contribution in disseminating of information, the Milton Avenue staff contributed more than could have been accomplished in many hours of meetings and workshops. They are to be gratefully thanked for their continued efforts toward this end of sharing their time and experience with interested visitors.

Milton Avenue School has provided its pupils with the opportunity to refine their skills in an educational setting. Its progressive faculty and staff have spent time and effort in experimental undertakings which have led to productive and creative teaching teachniques. Most importantly, however, Milton Avenue has maintained a spirit of inquiry regarding the purpose and effect of its existence as an educational institution. When all schools can respond as robustly to the consideration of alternative approaches and to the analysis of their own effectiveness, then schools generally will be most successful in their ultimate responsibility to educate children.

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ITEMS IN THE APPENDIX

APPENDIX NUMBER	
	Experiment I.
1	October and May scores for Metropolitan Readiness Tests: Statistical analysis using a one-tailed t-test for repeated measures.
2	Raw score averages for all children present during October and May MRT sessions.
3	Comparison of MRT scores under two testing conditions: Individual scores for Group B.
4	Comparison of MRT scores under two conditions: Individual scores for Group A.
	Experiments II and III.
5	Sample work sheets for all three subject areas from initial periods and ending periods of experiments.
	Experiment V.
6	Sample checklists used in EMR program.

OCTOBER AND MAY SCORES FOR METROPOLITAN READINESS TESTS: STATSITICAL ANALYSIS USING ONE-TAILED t-TEST FOR REPEATED MEASURES

Class	Mean Change	T-Value	Level of Significance	Number of Children
Hudson	+14.5	3.924	.005	12
Binkley	+ 5.3	2.198	.05	11
Senior	+ 0.2	0.073	Not Sign.	13
Moncus	+ 3.8	1.386	.10	12
Hatch	+ 5.0	2.098	.05	15
Carrothers	+ 1.9	0.874	Not Sign.	12
Clark	+ 6.0	1.852	.10	8
Daniel	+ 3.8	1.333	Not Sign.	8

RAW SCORE AVERAGES FOR ALL CHILDREN PRESENT DURING
OCTOBER AND MAY METROPOLITAN READINESS TESTS SESSIONS

Class	October Average	May Average	Average Change	Average Number of Children
Hudson	34.21	48.61	+14.40	13.5
Binkley	22.69	25.00	+ 2.31	15.0
Senior	32.69	32.84	+ 0.15	13.0
Moncus	37.92	39.70	+ 1.78	15.0
Hatch	27.58	35.12	+ 7.54	17.5
Carrothers	64.35	69.76	+ 5.41	13.5
Clark	39.00	56.20	+17.20	13.0
Daniel	28.07	31.50	+ 3.43	13.0

COMPARISON OF METROPOLITAN READINESS TESTS SCORES
UNDER TWO TESTING CONDITIONS: GROUP B (DANIEL)

Subject	Standard Conditions	Standard Conditions	Change in Score	Standard Conditons	Reinforce. Conditions	Change in Score
S-1	43	38	- 5	38	41	+ 3
S-2	33	44	+11	44	65	+21
S-3	49	53	+ 4	53	52	- 1
S-4	25	34	+ 9	34	38	+ 4
S-5	57	45	-12	45	66	+21

COMPARISON OF METROPOLITAN READINESS TESTS SCORES
UNDER TWO TESTING CONDITIONS: GROUP A (MONCUS)

Subject	Standard Conditions	Standard Conditions	Change in Score	Standard Conditions	Reinforce. Conditions	Change in Score
S-1	38	33	- 5	33	33	0
S-2	42	56	+14	56	54	- 2
S-3	40	46	+ 6	46	45	- 1
S-4	52	52	0	52	48	- 4
S-5	48	58	+10	58	57	- 1
S-6	43	66	+23	66	65	- 1
S-7	47	47	0	47	47	0
S-8	43	47	+ 4	47	53	+ 6
S-9	50	50	0	50	61	+11
S-10	33	41	+ 8	41	35	- 6

Sample work sheets for all three subject areas from initial sessions and from ending sessions of projects.

(Experiments II and III)

Name _____

Add:

4	5	6	8	2
+2	+1	+3	+1	+0
___	___	___	___	___

3	1	2	4	5
+3	+4	+2	+1	+2
___	___	___	___	___

Name _____

Add:

3	6	7	4	6	2
2	3	2	3	5	2
+4	+1	+2	+4	+0	+3

1	4	5	7	4	3
2	1	5	0	2	2
+5	+3	+1	+2	+1	+3

4	1	3	7	6	9
1	2	6	1	3	1
+2	+3	+2	+2	+3	+2

Name _____

Add:

8 +3	2 +7	5 +4	9 +3	8 +1	6 +5
4 +4	6 +0	2 +5	7 +3	6 +4	3 +6

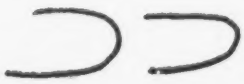
SubTracT:

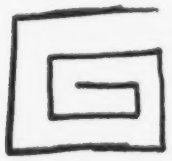
8 -5	4 -2	3 -1	5 -0	6 -4	7 -3	2 -2

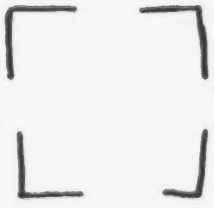
Copying -- Beginning of Program

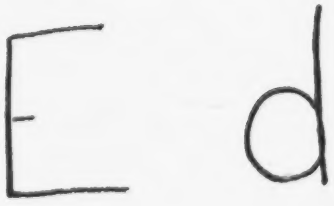
Name _____

Copy:









Copying -- End of Program

Name _____

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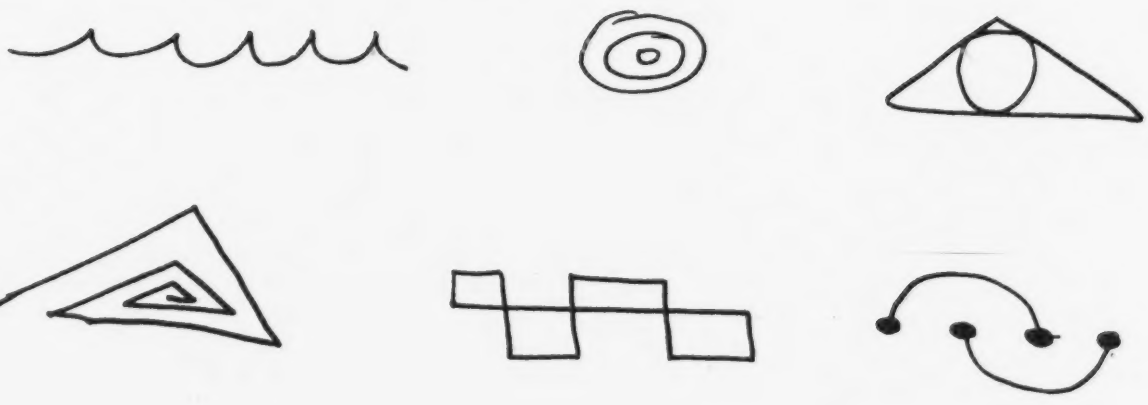

Name _____

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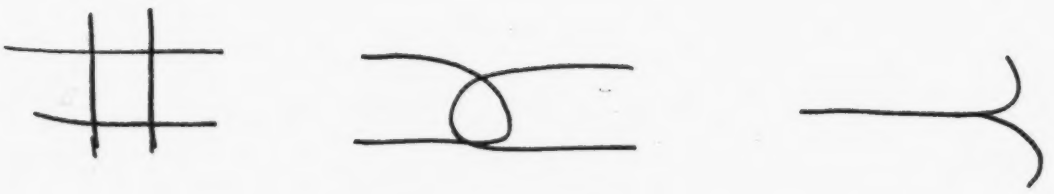

Name _____

Wait _____ Fire _____

Exit _____ Boys _____

Stop _____ Go _____

Hot _____

Cold _____

Walk _____

Poison _____

Sample checklists used in EMR classrooms.

(Experiment V)

I. Language Arts

I. General
   A. Level I - Primary
      1. Listening
         a. follows directions
         b. listens to others in group situations
         c. understands "why" of activity (purpose)
         d. listens to short stories of others
         e. knows high and low tones
         f. discrimination of music, urgency, pleasant sounds from others
      2. Speaking
         a. has good speech
         b. can express thoughts in simple sentences
         c. can use the telephone
         d. can ask and give simple directions
         e. can express himself well enough to make needs known
      3. Reading
         a. has a vocabulary of (5000?) words
         b. understands word content and can recognize words
         c. understands what he reads
         d. oral and silent reading
         e. functional reading
      4. Writing
         a. can write legibly and accurately with good posture
         b. writes name, address, birthdate
         c. writes letters and notes
         d. colors well.
         e. put together simple puzzles
         f. traces and follows dots
      5. Spelling
         a. spells meaningful words
         b. recognizes same letter in different words
         c. learns from E. Dolch list

B. Level II - Intermediate
   1. Listening
      a. extending primary skills: good listening habits
      b. understands information, explanations, and announcements
      c. listens and understands ETV or movies and records
      d. can identify rhyming sounds
      e. discrimination of familiar sounds extended (siren, cycle,truck)

   2. Speaking
      a. extending primary skills
      b. makes introductions
      c. engages in group discussions; sharing
      e. makes announcements
      f. speaks in complete sentences
      d. gives group reports
      e. uses telephone well
   3. Reading
      a. extending skills: reading letters of alphabet
      b. reads for protection
                information
                instruction (work sheets)
                pleasure
      c. reads current news (Weekly Reader)
      d. phonics: knows consonent sound and blends; beginning and ending sounds
   4. Writing
      a. writes name in cursive; good fine and gross motor control
      b. creative writing; copies
      c. orders items from a catalogue or magazine
      d. begins sentences with capital
      e. ends sentences with a . or ?
      f. writes in complete sentences
   5. Spelling
      a. systematic spelling skills
      b. dictation
      c. learning words from reading

II. Mathematics

A. Primary - Level I

1. uses numbers (in relating age and address)
2. a. rote counting 1 thru 5
   b. rote counting 6 thru 10
3. rationale (values) of numbers 1 thru 5
4. sets
   a. 1, 2, 3
   b. 4,5
5. concepts
   a. direction: up-down
   b. size: big-little
   c. weight: more-less
   d. motion: fast-slow
   e. amount: all-some
   f. time: first-last
   g. temperature: cold-hot
   h. distance: far-close
   i. comparison: larger-smaller
   j. measurement: long-short
   k. measurement : dozen-ounce
6. reading and writes numbers
   a. 1, 2, 3, 4, 5
   b. 6, 7, 8, 9, 10
7. recognizes names of numbers
   a. one, two
   b. three, four, five
8. ordinals
   a. first, second
   b. third, fourth
9. calendar
   a. says names of days
   b. locates names of days on calendar
   c. knows what month it is
   d. can locate the date of the month
   e. can tell about the weather
   f. can relate the year
10. time
    a. knows what a clock is
    b. knows morning is for getting up
    c. knows noon is for eating
    d. knows night is for goind to bed
    e. o'clock
    f. hour (knows meaning)
    g. can count hours to 10
    h. knows half-hour
11. recognizes arithmetic signs
    a. + (plus) adding
    b. = (equals)
    c. - (minus) subt. take away

12. money
    a. knows that money buys things
    b. recognizes penny, nickel, dime
    c. makes change for a dime (1¢ - 10¢)
13. Recognizes
    a. circle
    b. square
    c. ¢ sign
14. addition
    a. with no sum greater than 5
    b. with no sum greater than 10
15. subtraction
    a. no difference greater than 10
    b. numerator not greater than 10
16. measurement
    a. cup
    b. teaspoon
    c. tablespoon
    d. dozen
    e. pint
    f. quart
    g. gallon
    h. one-half of each
17. knows zero as a place holder
18. knows address and phone number

B. Intermediate - Level II
   1. Counting
      a. rote counting 1 thru 50
      b. rote counting 51 thru 100
   2. Values of numbers 1 thru 50
   3. a. Counting by decades 10 thru 50
      b. 60 thru 100
   4. Sets: a. simple addition
      b. simple subtraction
   5. a. Counting by 5's - 5 thru 50
      b. Counting by 2's - 2 thru 10
   6. Writes numbers
      a. 1 - 50
      b. 51 - 100
   7. Recognizes names of numbers
      a. six, seven
      b. eight, nine, ten
   8. Ordinals
      a. fifth, sixth
      b. seventh, eighth
   9. Calendar
      a. knows and recognizes the days of the week
      b. knows the date
      c. knows day of the week, month of the year, the year, and the weather record
   10. Time
      a. can tell time by the quarter hour
      b. can tell time by the minute
      c. understands A.M. and P.M.
      d. counts minutes 1 thru 50
      e. knows midnight, noon
   11. Recognizes
      a. ¢
      b. $
      c. @
   12. Money
      a. recognizes coins up to a dollar
      b. knows the value
      c. makes change for a quarter (=25¢)
      d. makes change for half dollar
      e. knows that 5 pennies make nickel, two nickels make dime, two quarters make half dollar
      *f. makes change for a dollar
      *g. able to make small purchases (less than $1.00)
   13. Recognizes
      a. triangle
      b. rectangle or oblong
   14. Addition
      a. sums of 19 or less (no carrying)

b. sums of 39 or less (no carrying)
c. one place column of three numbers, no sum over 10
*d. simple oral problems
*e. two place numbers with carrying

15. Subtraction
    a. simple oral and written, no remainder over 19
    b. more difficult
    c. two place problems with carrying
16. Measurement
    a. pint
    b. quart
    c. gallon
    d. 1/2 of each
    e. feet
    f. 12 inches
    g. 1/4 of each
    h. yard
    i. 1/3 of group
17. Meaning of terms
    a. tens
    b. teens
    c. ones
    d. units
    e. review
18. Place values in numbers: ones, tens, hundreds

III. Social Skills

A. Primary

1. knows and tells first name
2. knows and tells age
3. knows if he has a phone
4. knows what belongs to him, to others
5. shares, takes turns, cooperates
6. accepts limits
7. respects authority of school personnel
8. knows rules concerning: Excuse me.
   Thank you.
   Please.
9. can locate: classroom
   principal's office
   playground
   lunchroom
   bathroom
10. knows and observes school rules
11. plays in small groups
12. can draw a picture of family and talk about "family"
13. dramatizations

B. Intermediate

1. knows and tells full name
2. knows and tells house number, street name
3. knows and tells telephone number
4. has preferences in games, food, clothing, friends
5. accepts authority of teachers, principal, teacher aide, etc.
6. knows and tells names of classmates
7. knows how to cooperate with classrmates
8. knows how and why of taking one's turn
9. good table manners
10. accepts responsibility as a group member
11. draws picture of own neighborhood
12. learns directions from signs in classroom (stop, go, wait, etc.)